# NHTSA Air Bag Out-Of-Position Testing

### Allison E. Louden

Vehicle Research and Test Center/NHTSA E. Liberty, Ohio

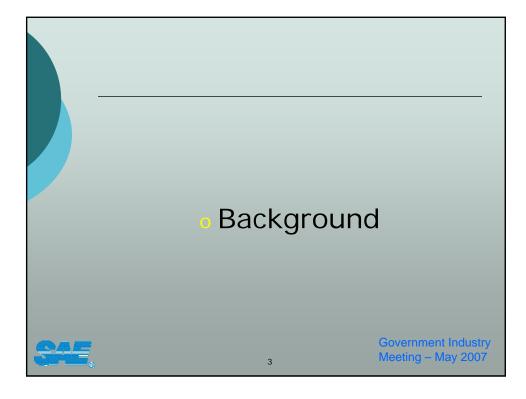




### **Outline**

- Background
- Recent Side Air Bag OOP Testing
- Observations
- Future Side OOP Work
- Frontal OOP Testing





### Side Air Bag Background

- 1999 2000 Technical Working Group (TWG) was formed -produced the "Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Air Bags"
- 2000-2001 NHTSA began evaluating side air bags
- Dec. 2003 Auto Alliance announced Voluntary Commitment to enhance head protection for side impacts
- 2004 NCAP began conducting OOP testing.



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### Original Study 2000-2001

- Evaluated the TWG Procedures using MY99-00 fleet
- Results:
  - Many of the thoracic air bags were aggressive in OOP test conditions
  - Curtain air bags were benign
  - TWG test positions were limited in certain areas, but NHTSA did agree that the guidelines were capable of finding aggressive SAB systems



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### SIDIIs Dummy Changes

- Build Level C SIDIIs
  - Used in 99-2001 study
  - Thoracic air bag TWG OOP testing damaged instrumentation and dummy
  - NHTSA designed new dummy FRG
- Floating Rib Guide (FRG) and Build Level D
  - Used in MY04 and MY05 testing



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• Recent Side Air Bag Research

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### **Vehicle Selection**

- 2000 BMW 528i (SIDIIs only)
- MY2004: Volvo XC90, Toyota Sienna, Honda Accord
- MY2005: VW Jetta, Honda CRV, Toyota Corolla, Ford 500, Subaru Forester, Saab 93
  - Vehicles were tested in all rows



### **Test Objective**

- Evaluate the dummies using TWG positions in all rows.
- Evaluate the interaction of the dummies and the roof mounted air bags in the 2<sup>nd</sup> and 3<sup>rd</sup> rows
  - Develop seating positions if needed



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### TWG Test Configurations

- TWG guidelines based on style of air bags
  - Hybrid III 3YO
    - Seat mounted (TWG 3.3.3.1 3.3.3.4 (4 tests))
    - Door mounted (TWG 3.3.4.1 3.3.4.4 (4 tests))
    - Roof rail mounted none
  - Hybrid III 6YO
    - Seat mounted (TWG 3.3.3.5)
    - Door mounted none
    - Roof rail mounted (TWG 3.3.5.1)
  - SID-IIs
    - Seat mounted (TWG 3.3.3.6 and TWG 3.3.3.7)
    - Door mounted (TWG 3.3.4.5)
    - Roof rail mounted (TWG 3.3.5.2 and TWG 3.3.5.3)

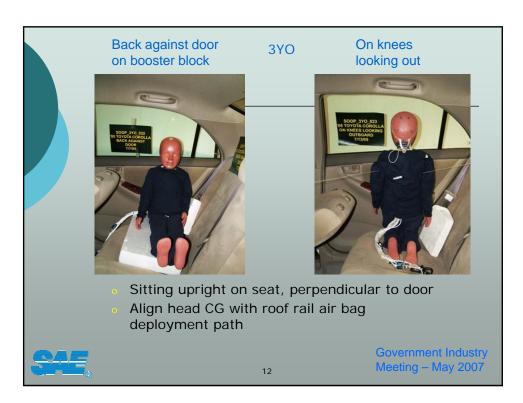


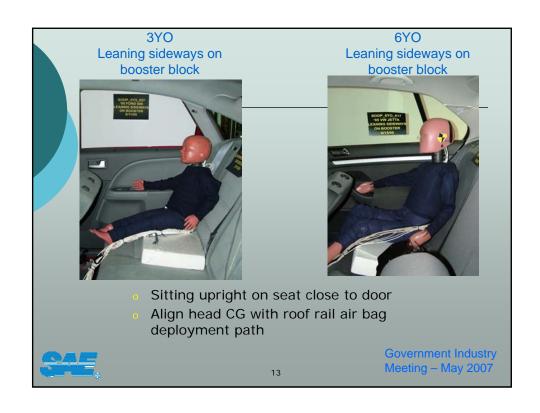
## NHTSA Positions to Evaluate Roof Rail Air Bags

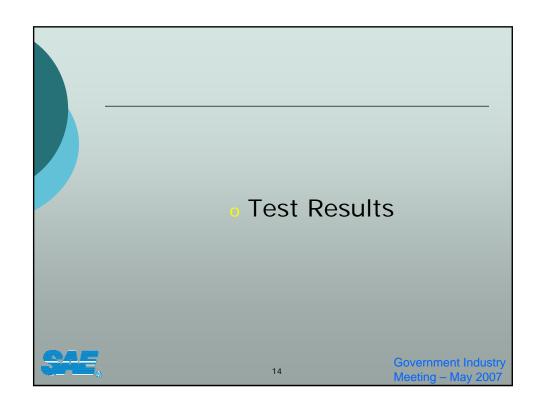
- New OOP seating positions were created for the roof rail mounted air bags
  - Hybrid III 3YO
    - Back against door on booster block
    - On knees looking out side window
    - Leaning sideways on booster block
  - Hybrid III 6YO
    - Leaning sideways on booster block
  - \*\*New procedures all based off of TWG seating procedures



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### Hybrid III 3YO and 6YO

- 62 tests were conducted with 9 vehicles
  - 30 thoracic (2 tests curtain was deployed also)
  - 32 curtain
- 3/62 tests exceeded the IARV responses marginally
  - The 3YO exceeded the IARV in TWG 3.3.3.1 and TWG 3.3.3.2 (different vehicles)
  - The 6YO exceeded the IARV in TWG 3.3.3.5
- 4/62 tests had elevated responses (80% to 100% of IARV)
  - 3 tests with 3YO
  - 1 test with 6YO
- None of the 32 curtain tests exceeded the IARVs.



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# SOOP\_3YO\_023 O5 TOYOTA COROLLA ON KNEES LOOKING OUTBOARD 7/13/05

### **SIDIIs Dummy**

- 34 tests conducted on 10 vehicles
  - 12 thorax tests
  - 22 curtain tests (5 tests deployed thorax bag also)
- None of the tests exceeded the IARV
- 3 tests had elevated responses (80% to 100% of IARV)
  - Rib deflection



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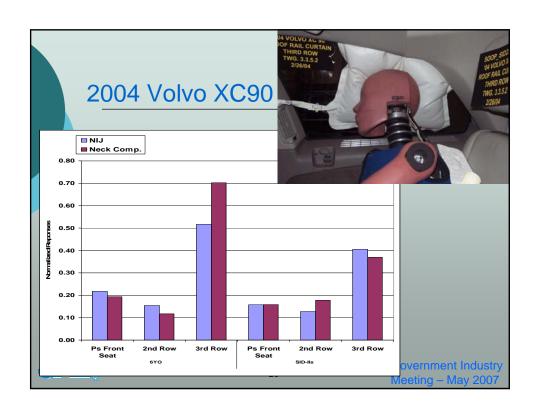
00 BMW 528i
SIDIIS\_019
TWG 3.3.4.5
(THORAX)
4/04/06

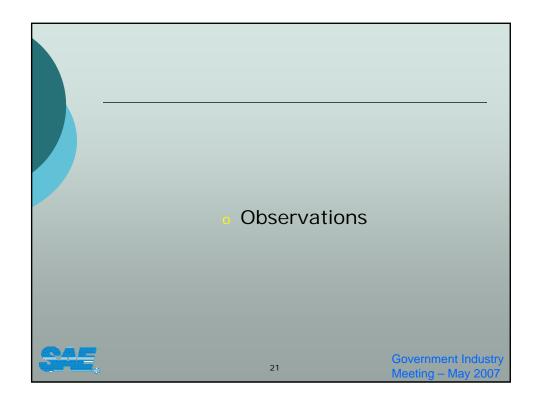
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### Curtain air bags continued

- 6YO and SIDIIs were tested in all three rows of the 2004 Volvo XC90 and 2004 Toyota Sienna using the same TWG positions (TWG 3.3.5.1 and TWG 3.3.5.2)
  - Both air bags produced similar responses in all three rows for the Toyota Sienna, but the Volvo XC90 produced higher results in the 3<sup>rd</sup> row.
    - Possibly due to the individual air bag







### **Test Observations**

Total of 96 tests conducted on 10 vehicles

- Only 3 test configurations exceeded 1 or more IARVs – thoracic style of air bag.
- Curtain air bags produced low head and neck results for all three dummies.
- TWG guidelines for the seating positions can be easily used in all rows with minor modifications.
- TWG does not currently have a seating position for the 3YO for roof mounted air bags.



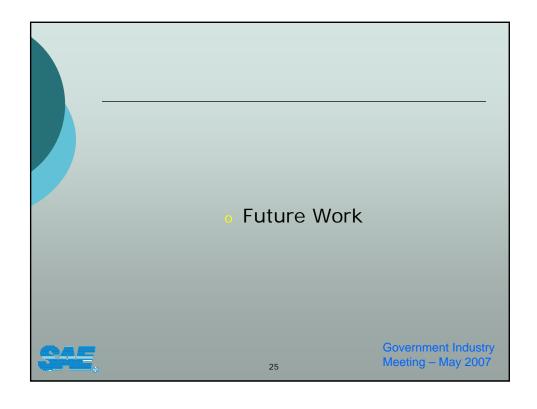
# Additional Curtain Air Bags Static Deployment Observations

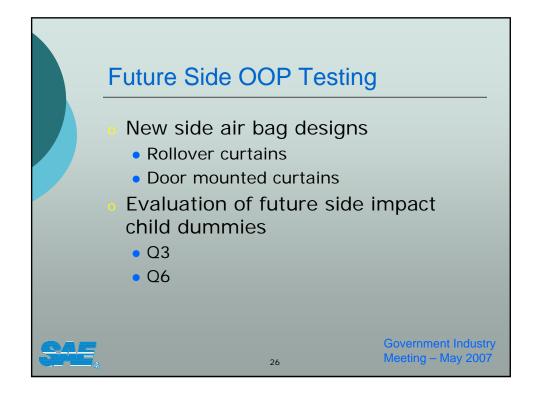
- In some instances as the curtain deployed it pushed the dummy in between the side glass and the air bag.
  - Occurred in ~30% of our testing
  - Further research to be conducted

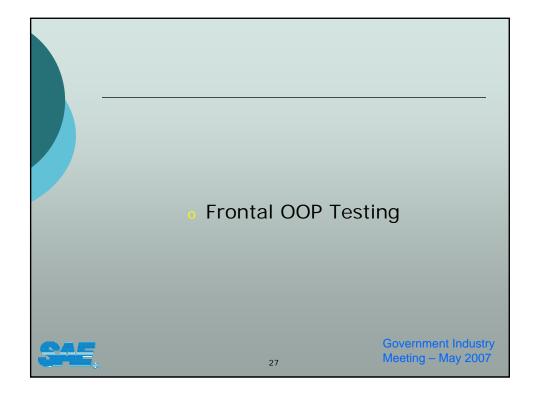


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### Frontal Out of Position Background

Late 1990's frontal air bags were mandated 2000 - FMVSS 208 upgrade

- Phase in period to allow manufacturers to choose to certify the frontal air bags by Low Risk Deployment, Suppression or Dynamic OOP.
- 2001-2005 NHTSA monitored the air bags to see how the fleet changed.
  - As the frontal air bags changed NHTSA monitored them by conducting OOP testing with the Hybrid III 3YO, 6YO, and 5<sup>th</sup> female dummies.
- 2005 Phase in complete -FMVSS 208 low risk deployment and suppression testing is currently conducted by compliance.



### Recent Year Frontal OOP Testing

- 0 2004
  - Performed OOP testing with 10YO dummy on 5 vehicles
    - ~80% of the tests passed the IARVs
    - Only 2/5 vehicles were certified for LRD testing with the 6YO
  - Parametric study with 3 MY02 vehicle air bags and 6YO and 5<sup>th</sup> female dummies
    - Limited study looked at the effects of moving the dummy vertically, laterally and longitudinally



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### **Present Testing**

- 2006- Present
  - Evaluating parametric study with MY2006 new air bag technology
    - Takata Dual Chamber
    - GM Dual Depth
    - Autoliv Cinch Tube
    - LRD Bags





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### Frontal OOP changing

- Initially, a high percentage of vehicle manufacturer's chose suppression for the child dummies.
- More recently vehicles are complying with the 6YO in the low risk deployment mode.
- New strategy is to incorporate the 3YO and possibly the CRABI dummies in LRD test modes.

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- Future technology possibilities:
  - DASS



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### Related Papers

- NHTSA Technical Report (2002): "Side Air Bag Research: Static Testing of Side Impact Air Bags Using Three and Six Year Old HybridIII Dummies and the 12 month CRABI Dummy"
- 17th ESV Conference (2001)
  - Paper #331: "Evaluation of Injury Risk from Side Impact Air Bags"
- 18th ESV Conference (2003)
  - Paper #427: "Injury Risks From Advanced Air Bags in Frontal Static OOP Tests"
- 19th ESV Conference (2005)
  - Paper #05-0395: "Evaluation of Frontal Air Bag Performance"
- 20th ESV Conference (2007)
  - Paper #07-213: "Side Air Bag Out-Of-Position Testing of Recent Model Year Vehicles"



### Thanks for your attention

Allison E. Louden
NHTSA / VRTC
allison.louden@dot.gov
937-666-4511



